REMARKS

The Office Action mailed September 10, 2004, has been received and reviewed. Claims 1-25 are currently pending in the application. Claims 1 and 21 are objected to and Claims 1-25 stand rejected. Reconsideration is respectfully requested.

Information Disclosure Statement

Applicants have enclosed, with this amendment, an Information Disclosure Statement pursuant to 37 CFR 1.98(b) as requested by the Examiner. Those references cited in the specification of the present application, which are not included in the Information Disclosure Statement are textbooks or publications disclosing standards in the industry, the contents of which would likely be known to a person of ordinary skill in the art at the time of the present invention.

Claim Objections

Claim 1 is objected to because of an informality wherein "into wavelet domain" should be changed to "into a wavelet domain." Claim 1 has been so amended. Similar corrections have been made to claims 12, 16, 20, 23, and 25.

Claim 21 is objected to because of an informality wherein "reconstructing a zerotree from an encoded image" should be deleted because it is redundant. Claim 21 has been so amended.

35 U.S.C. § 112 Rejections

Claims 19-24 stand rejected under 35 U.S.C. § 112, first paragraph, as reciting a single means wherein the means recitation does not appear in combination with another recited element of means (see MPEP 2164.08a). Applicants respectfully request that the rejection be withdrawn.

Claim 19 has been canceled.

Regarding claim 20, claim 20 has been rewritten in independent form, which is no longer indefinite for reciting a single means wherein the means recitation does not appear in combination with another recited element of means (see MPEP 2164.08a). Therefore, Applicants respectfully request that the 35 U.S.C. § 112, first paragraph rejection of claim 20 be

withdrawn.

Regarding, claim 21, claim 21 is amended to depend from amended claim 20. Therefore, Applicants respectfully request that the 35 U.S.C. § 112, first paragraph rejection of claim 21 be withdrawn.

Claim 22 has been canceled.

Regarding claim 23, claim 23 has been rewritten in independent form, which is no longer indefinite for reciting a single means wherein the means recitation does not appear in combination with another recited element of means (see MPEP 2164.08a). Therefore, Applicants respectfully request that the 35 U.S.C. § 112, first paragraph rejection of claim 23 be withdrawn.

Regarding, claim 24, claim 24 depends from amended claim 23. Therefore, Applicants respectfully request that the 35 U.S.C. § 112, first paragraph rejection of claim 24 be withdrawn

35 U.S.C. § 102(e) Anticipation Rejections

Claims 19 and 22 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Beck (U.S. Patent 6,256,756).

These claims have been canceled, thus resolving the rejection.

35 U.S.C. § 103(a) Obviousness Rejections

Claims 1-2, 9, 11-12, 16, 18, 20-21, and 23-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Beck (U.S. Patent 6,256,756) in view of Shapiro, "Embedded Image Coding Using Zerotree of Wavelet Coefficients," *IEEE Transactions on Signal Processing*, vol. 41, pp. 3445-3462, December 1993). Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicants note that the Office Action cites Shapiro as (J.M Shapiro, "Embedded Image Coding Using Zerotree of Wavelet Coefficients," *IEEE Transactions on Signal Processing*, vol. 1, no.2, pp. 205-220). Applicants believe the Shapiro reference should be cited as "Embedded Image Coding Using Zerotree of Wavelet Coefficients," *IEEE Transactions on Signal Processing*, vol. 41, pp. 3445-3462, December 1993), and Applicants have presented their

arguments based on this cited reference. Please notify Applicants' undersigned attorney if the Shapiro reference cited by the Applicants is incorrect.

Regarding claim 1, the Office Action states (page 5, item 10.iv of the Office Action) that:

"[v]ector quantization (VQ) encoding all other subbands of the pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of the digital image is not explicitly explained by Beck. Beck does explain lossy compressing LH, HL, and HH representations (corresponding to the all other subbbands) in the abstract. Beck further explains that the lossy compression comprises performing a discrete cosine transform (DCT) **followed by Huffman coding (VQ)** in column 7, lines 1-22. However, Beck does not explicitly explain encoding based on a zerotree insignificance prediction. Shapiro explains that the zerotree wavelet algorithm is a simple and effective image compression algorithm in the abstract. Shapiro also explains that the zerotree wavelet algorithm does not require training, pre-stored tables or cookbooks, or knowledge of the image source, thereby reducing the optimization time required to perform compression. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to **perform encoding based on a zerotree insignificance prediction**, as suggested by Shapiro, **rather than encoding based on DCT method**, as suggested by Beck, because the processing and/or time required to perform optimized compression will be reduced" (emphasis added).

Applicants respectfully disagree with some of the assertions made in the Office Action. First, the Office Action appears to equate Huffman coding with vector quantization as evidenced by the statement "(DCT) followed by Huffman coding (VQ)." Huffman coding and vector quantization are very different processes with different goals. Huffman coding is an entropy encoding process, which is generally intended to losslessly reduce the number of bits required to represent a data set. On the other hand, vector quantization is generally a lossy algorithm intended to reduce the amount of data in the data set by removing some hopefully less important data from the data set.

Furthermore, Applicants can find no reference to vector quantization anywhere in Beck. Applicants respectfully submit that a reference to Huffman coding cannot be substituted for teaching or suggesting vector quantization.

Similarly, Shapiro does not teach or suggest vector quantization in relation to a zerotree

insignificance prediction. Rather Shapiro teaches that "[t]o perform the embedded coding, successive-approximation quantization (SAQ) is applied. As will be seen, SAQ is related to bit-plane encoding of the magnitudes. The SAQ sequentially applies a sequence of thresholds T_0, $\cdots$, T_{N-1} to determine significance" (page 3453, col. 1, penultimate paragraph). The SAQ encoding of Shapiro may be considered a type of **scalar quantization** of each wavelet coefficient based on a selected hard threshold for each approximation sequence. Whereas, "[a]n important aspect of the method 100 of the present invention is the zerotree quantizer on the discrete wavelet transform (DWT) coefficients performed in the VQ encoding 108 of subbands other than the LL subband, hereinafter referred to as the wavelet rate-distortion adaptive residual vector quantizer (WRDADRVQ). The zerotree prediction is implicitly applied in the rate-distortion optimization. No hard thresholding is required according to the method 100 of the present invention" (paragraph 0055). In other words, the VQ encoding enables an amount of quantization optimized for the desired rate-distortion trade-off, which is adaptable to the data being compressed. In addition, there is a significant difference in complexity, and possibly compression effectiveness, between the scalar quantization of Shapiro and the vector quantization of the present invention. The vector quantization of the present invention may require additional processing time or processing resources, but may develop a more optimum compression of image quality relative to the amount of compression achieved.

Additionally, Applicants believe the assertion in the Office Action that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to **perform encoding based on a zerotree insignificance prediction**, as suggested by Shapiro, **rather than encoding based on DCT method**," does not address what is recited in claim 1. First, the DCT method of Beck operates on each level of the wavelet pyramid hierarchy separately. On the other hand, **zerotree insignificance prediction** operates across the pyramid hierarchy levels of a wavelet transformation. Second, Applicants assert that claim 1 claims "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction." The spatial to frequency transform of a DCT is significantly different than vector quantizing a data set by defining a code vector for a group of data elements in the data set.

As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all

the claim elements of claim 1 as required by 35 U.S.C. § 103(a). Namely, the cited references do not teach or suggest "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a **zerotree insignificance prediction**." Therefore, claim 1 is now allowable and Applicants respectfully request that the rejection of claim 1 be withdrawn.

Regarding claim 2, this claim depends from non-obvious claim 1. Therefore, Applicants respectfully request that the rejection of claim 2 be withdrawn.

Regarding claim 9, once again, the Office Action appears to be equating Huffman encoding to VQ encoding with the statement "Beck explains VQ encoding (through a Huffman encoder) by optimization of a threshtree." As explained in the analysis of claim 1, Applicants respectfully assert that a reference to Huffman coding cannot be substituted for teaching or suggesting vector quantization. Furthermore, Applicants can find no teaching or suggestion in Beck to "**rate-distortion optimization** along a threshtree." While, Beck may show a threshtree in Fig. 5, Beck does nothing to teach or suggest optimizing for the desired rate-distortion trade-off along a threshtree. In addition, while Shapiro may suggest accepting a given distortion to fit the rate of a communication channel or storage space of a storage device, Shapiro does not teach or suggest optimizing the rate-distortion trade-off or using vector quantization encoding to achieve this optimization.

As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of claim 9 as required by 35 U.S.C. § 103(a). Namely, the cited references do not teach or suggest "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a **zerotree insignificance prediction**," as recited in claim 1, from which claim 9 depends. Furthermore, Beck and Shapiro, either individually or combined, do not teach or suggest, "wherein said VQ encoding comprises **rate-distortion optimization** along a threshtree." as recited in claim 9. Therefore, claim 9 is not obvious and Applicants respectfully request that the rejection of claim 9 be withdrawn.

Regarding claim 11, similar to claim 1, Applicants respectfully assert that Beck does not teach or suggest the element of "**vector quantization decoding** subbands in said encoded image other than a top LL subband," as recited in claim 11. As stated earlier, Applicants can find no reference to vector quantization anywhere in Beck, and Applicants respectfully submit that a

reference to Huffman coding cannot be substituted for teaching or suggesting vector quantization.

The Office Action states that "[v]ector quantization decoding subbands in the encoded image other than a top LL subband is illustrated by Beck in figure 10 by the dequantize coefficient stage 110." Applicants respectfully assert that the dequantize coefficient stage 110 in Beck is applied to coefficients of the DCT transformation, not coefficient of a vector quantization. In addition, Shapiro does not teach or suggest vector quantization in relation to the zerotree insignificance prediction, let alone vector quantization decoding.

As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of claim 11 as required by 35 U.S.C. § 103(a). Namely, the cited references do not teach or suggest "**vector quantization decoding** subbands in said encoded image other than a top LL subband." Therefore, claim 11 is not obvious and Applicants respectfully request that the rejection of claim 11 be withdrawn.

Regarding claim 12, amended claim 12 includes, among other things, the claim elements of "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a **zerotree insignificance prediction**, thereby obtaining a lossy encoded portion of said digital image," as also recited in claim 1. Amended claim 12 further includes the claim element of "**vector quantization decoding** subbands in said encoded image other than a top LL subband," as also recited in claim 11. Therefore, for the reasons stated above for claim 1 and claim 11, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of amended claim 12 as required by 35 U.S.C. § 103(a). As a result, amended claim 12 is not obvious and Applicants request that the rejection of claim 12 be withdrawn.

Regarding claim 16, amended claim 16 includes, among other things, all the subject matter of claim 1. Therefore, the arguments set forth above for claim 1 are equally applicable to claim 16. As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of amended claim 16 as required by 35 U.S.C. § 103(a). Namely, the cited references do not teach or suggest "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a **zerotree insignificance prediction**." Therefore, amended claim 16 is not obvious and Applicants request that the rejection of claim 16 be withdrawn.

Regarding claim 18, claim 18 includes, among other things, all the subject matter of claim 11. Therefore, the arguments set forth above for claim 11 are equally applicable to claim 18. As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of claim 18 as required by 35 U.S.C. § 103(a). Namely, the cited references do not teach or suggest "**vector quantization decoding** subbands in said encoded image other than a top LL subband." Therefore, claim 18 is not obvious and Applicants request that the rejection of claim 18 be withdrawn.

Regarding claim 20, amended claim 20 includes, among other things, the claim element of "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a **zerotree insignificance prediction**, thereby obtaining a lossy encoded portion of said digital image," as also recited in claim 1.Therefore, the analysis set forth with respect to claim 1 is equally applicable to amended claim 20. As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of amended claim 20 as required by 35 U.S.C. § 103(a). Therefore, amended claim 20 is not obvious and Applicants request that the rejection of claim 20 be withdrawn.

Regarding claim 21, this claim depends from non-obvious amended claim 20. Therefore, Applicants request that the rejection of claim 21 be withdrawn.

Regarding claim 23, amended claim 23 includes, among other things, all the subject matter of claim 1. Therefore, the arguments set forth above for claim 1 are equally applicable to amended claim 23. As a result, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of amended claim 23 as required by 35 U.S.C. § 103(a). Namely, the cited references do not teach or suggest "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on a **zerotree insignificance prediction.**" Therefore, amended claim 23 is not obvious and Applicants request that the rejection of claim 23 be withdrawn.

Regarding claim 24, this claim depends from non-obvious amended claim 23. Therefore, claim 24 is non-obvious and Applicants request that the rejection of claim 24 be withdrawn.

Regarding claim 25, amended claim 25 includes, among other things, the claim element of "**vector quantization (VQ) encoding** all other subbands of said pyramid hierarchy, based on

a **zerotree insignificance prediction,** thereby obtaining a lossy encoded portion of said digital image," as also recited in claim 1. Amended claim 12 further includes the claim element of **"vector quantization decoding** subbands in said encoded image other than a top LL subband," as also recited in claim 11. Therefore, for the reasons stated above for claim 1 and claim 11, Beck and Shapiro, either individually or combined, do not teach or suggest all the claim elements of amended claim 25 as required by 35 U.S.C. § 103(a). As a result, amended claim 25 is not obvious and Applicants request that the rejection of claim 25 be withdrawn.

35 U.S.C. § 103(a) Obviousness Rejections

Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Beck in view of Shapiro, and further in view of Zeng et al. (U.S. Patent 6,236,757). Applicants respectfully traverse this rejection, as hereinafter set forth.

Regarding claim 3, this claim depends from non-obvious amended claim 1. Therefore, claim 3 is not obvious and Applicants request that the rejection of claim 3 be withdrawn.

35 U.S.C. § 103(a) Obviousness Rejections

Claims 4-8, 13-15, and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Beck in view of Shapiro, and further in view of admitted prior art. Applicants traverse this rejection, as hereinafter set forth.

Regarding claims 4-8, these claims depend from non-obvious amended claim 1. Therefore, claims 4-8 are not obvious and Applicants respectfully request that the rejection of claims 4-8 be withdrawn.
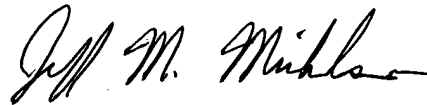
Regarding claims 13-15, these claims depend from non-obvious amended claim 12. Therefore, claims 13-15 are not obvious and Applicants respectfully request that the rejection of claims 13-15 be withdrawn.

Regarding claims 17, this claim depends from non-obvious amended claim 16. Therefore, claim 17 is not obvious and Applicants respectfully request that the rejection of claim 17 be withdrawn.

CONCLUSION

Claims 1-18, 20-21, and 23-30 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,

Jeff M. Michelsen
Registration No. 50,978
Attorney for Applicants
TRASKBRITT
P.O. Box 2550
Salt Lake City, Utah 84110-2550
Telephone: 801-532-1922

Date: December 16, 2004
JMM/rmh
Document in ProLaw

IN THE DRAWINGS:

The attached annotated sheet of drawings includes FIG. 2 and replaces the original sheet including FIG. 2. Specifically, FIG. 2 has been revised to add a legend designating FIG. 2 as prior art, as requested by the Examiner. Applicants will present formal drawings with the proposed correction with the next communication from Applicants.